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EXAMINER				
WANG, CHUN CHENG				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/551,071

Applicant(s)

SONEZAKI ET AL.

Examiner

Chun-Cheng Wang

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1796

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 14-22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/IS/CI)
Paper No(s)/Mail Date 09/27/2005, 06/29/2006
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restriction

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 1-13, drawn to 'surface modified TiO₂ and its dispersion'.

Group II, claim(s) 14-22, drawn to 'process for producing surface modified TiO₂'.

2. The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the expression "special technical features" shall mean those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art. The prior art cited is evidence that the claimed inventions, considered as a whole, do not define a contribution over the prior art. Please see PCT Rule 13.2. Okabe discloses a method for producing surface treated TiO₂ powder, i.e. crystal, in a uniform dispersion (reading on instant claim 8).

3. During a telephone conversation with Mr. Clifford Mass on August 29, 2008 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-

13. Affirmation of this election must be made by applicant in replying to this Office action.

Claims 14-22 have been withdrawn from further consideration by the examiner, 37

CFR 1.142(b), as being drawn to a non-elected invention.

4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the

application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

5. The examiner has required restriction between product and process claims. Where applicant elects claims directed to the product, and the product claims are subsequently found allowable, withdrawn process claims that depend from or otherwise require all the limitations of the allowable product claim will be considered for rejoinder. All claims directed to a nonelected process invention must require all the limitations of an allowable product claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product are found allowable, an otherwise proper restriction requirement between product claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product claim will not be rejoined. See MPEP § 821.04(b). Additionally, in order to retain the right to rejoinder in accordance with the above policy, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product claims. **Failure to do so may result in a loss of the right to rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Priority

6. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Double Patenting

7. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 1-8 and 10-11 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-7, and 13-15 of copending Application No. 10551164. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented. Although the conflicting claims are not identical, they are not patentably distinct from each other because both applications claim the titanium dioxide modified with a hydrophilic polymer having carboxyl groups bonded to titanium dioxide through an ester linkage in the same scope. Both applications claim the titanium dioxide is an anatase or rutile form; has a particle diameter of 2 to 200 nm; the titanium dioxide is a

composite titanium dioxide comprising titanium dioxide and a magnetic material; the hydrophilic polymer is water soluble polymer; and the water soluble polymer contains a polycarboxylic acid. Both applications claim a dispersion liquid of surface modified titanium dioxide fine particle in the same scope. Both applications claim the dispersion is dispersed in aqueous solvent; the aqueous solvent is a pH buffered solution; and the aqueous solvent is physiological saline.

Claim Objections

9. Delete "any one" in claim 12, line 2.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Regarding claim 12, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1-2 and 5-8 are rejected under 35 U.S.C. 102(b) as being anticipated by Okabe (JP11255516A), English translation is used as reference.

Applicants recite surface modified titanium dioxide fine particles comprising titanium dioxide having a surface which is modified with a hydrophilic polymer having carboxyl groups, the carboxyl groups in the hydrophilic polymer being bonded to titanium dioxide through an ester linkage (claim 1), wherein said titanium dioxide is an anatase or rutile form of titanium dioxide (claim 2); the hydrophilic polymer is a water soluble polymer (claim 5); the water soluble polymer contains a polycarboxylic acid

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(claim 6), and the water soluble polymer comprises a copolymer having a plurality of carboxyl group units in its molecule (claim 7); and the surface modified titanium dioxide fine particles is dispersed in an aqueous solvent (claim 8).

Okabe discloses a method for producing TiO₂ powder, i.e. crystal, in a uniform dispersion (read on claim 8), comprising reacting (a) a oxypolycarboxylic acid, (read on hydrophilic polymer is a water soluble polymer in claims 5 and 6 and plurality of carboxyl group unit in its molecule in claim 7), with (b) a polyol compound and (c) a complex alkoxide having a chemical bond of (-Ti-O-Al-O-Ti-) to provide a water-soluble composite ester complex oligomer (read on claim 1) (page 1, claim1). TiO₂ granular material, -COOTi-Al(COO)O-TiOOC-, (page 8, lines 5-13) obtained could be anatase, rutile or the mixture of anatase and rutile forms (read on claim 2) (page 22, last four lines).

13. Claims 1-3 and 5-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Sakamoto et al. (US5049309).

Applicants further recite the titanium dioxide has a particle diameter of 2 to 200 nm (claim 3) and the dispersion liquid has a pH value of 3 to 13 (claim 9).

Sakamoto et al. disclose an aqueous dispersion of finely-divided titanium oxide has a neutral pH range (Abstract), which contains partially-crystallized amorphous oxides containing a rutile or anatase type or a mixture of both (column 2, lines 8-38). Carboxymethyl cellulose may be added as dispersion-stabilizer (column 2, lines 46-51). The titanium dispersion can be concentrated by heating with stabilizer (column 3, lines 63-64) (i.e. carboxyl group in the carboxymethyl cellulose polymer bonds to titanium dioxide through ester linkage). Sakamoto et al. also disclose an aqueous dispersion containing more than 80% hydrous titanium oxide particles having a maximum particle size less than 0.1 μm and at least one dispersion-stabilizer selected from water-soluble organic compounds (column 6, claim 1).

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14. Claims 1, 3 and 5-7 are rejected under 35 U.S.C. 102(b) as being anticipated by Robb (US5068056).

Robb disclose 50 g of the dried coated TiO₂ product was added to 70 ml of water and 5.03 g of the sodium polyacrylate (page example 3) and the 40% TiO₂ aqueous dispersion was incorporated into the water in oil sunscreen formulation and heated at 70°C (page 13 example 21). Some ester formation would have been expected. Robb also disclose the particles of titanium dioxide have a largest dimension within the range 0.01 to 0.15 micron (column 1, lines 66-67).

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

The disclosure of Okabe is adequately set forth above and is incorporated herein by reference.

17. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okabe (JP11255516A) in view of Huang et al. ("Bactericidal mode of titanium dioxide photocatalysis", Journal of Photochemistry and Photobiology A: Chemistry 130 (2000) 163-170).

Applicants recite: The surface modified titanium dioxide fine particles according to claim 1, wherein said titanium dioxide has a particle diameter of 2 to 200 nm.

Okabe discloses the TiO₂ powder is synthesized using a spray pyrolysis method, and the water soluble composite carboxylic acid ester complex oligomer solution will reach the recovery part within approximately 1 second after being sprayed within the pyrolysis furnace, so the heat history duration will be exceedingly short, making it possible to ensure that there will be little agglutination with no grain growth of the grains, and to obtain an exceedingly fine TiO₂ powder (page 11, lines 8-16).

Okabe is silent on the particle diameter of 2 to 200 nm.

Huang et al. disclose when exposed to near-UV light, titanium dioxide (TiO₂) exhibits a strong bactericidal activity. It has been found that smaller TiO₂ particles cause quicker intracellular damage (Abstract, lines 1 and 10). The photocatalyst used in this study was TiO₂ (P25, Degussa AG, Germany) with a surface area of 50m²g⁻¹ and a primary particle size of 20 nm (page 3, 2.2 Photocatalytic reaction, lines 1-3).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains to manufacture the TiO₂ particles size of claimed range to allow the particles to penetrate targeted cell for better bactericidal applications of titanium dioxide photocatalysis.

18. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okabe (JP11255516A) in view of Watson et al. ("Synthesis of a Novel Magnetic Photocatalyst by

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Direct Deposition of Nanosized TiO₂ Crystals onto a Magnetic Core”, Journal of Photochemistry and Photobiology A: Chemistry 148 (2002) 303-313).

Applicants recite: The surface modified titanium dioxide fine particles according to claim 1, wherein said titanium dioxide is a composite titanium dioxide comprising titanium dioxide and a magnetic material.

Okabe is silent on the titanium dioxide composite comprises titanium dioxide and a magnetic material.

Okabe teaches all the limitations of claim 4 except incorporating the magnetic material in the titanium dioxide composite.

Watson et al. disclose a study in which nanocrystalline titanium dioxide particles were directly coated onto a magnetic core. A modified hydrolysed alkoxide process, in which the hydrolysis and condensation of a titanium alkoxide (titanium isopropoxide) was carried out under acidic conditions, using a large water:alkoxide ratio, allowed for the synthesis of crystalline titanium dioxide at relatively low temperatures (90°C) (Abstract, lines 1-4).

Modifying the properties of one material by coating it with another type of material has been a popular approach widely documented. In this work, the concept of coating one material with another is used to develop a novel magnetic photocatalyst. The photocatalyst is produced by coating a layer of the photoactive material titanium dioxide onto the surface of a magnetic core. In this case, both the core and the shell are of interest. The magnetic core is useful for enhancing the separation properties of suspended particles from solution, whereas the photocatalytic properties of the outer titanium dioxide are used to destroy organic contaminants in wastewaters (Introduction and background, lines 1-13).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains to utilize the teaching from Watson et al. to incorporate magnetic material with the Titanium dioxide nanoparticles that could enhance separation property of dispersed particles from dispersion.

19. Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okabe (JP1125516A) in view of Blake et al. ("Application of the Photocatalytic Chemistry of Titanium Dioxide to Disinfection and the Killing of Cancer Cells", Publisher: Taylor & Francis, Journal: Separation and Purification Methods, Volume 28 Issue 1, 1999, pp1-50).

20. Regarding claims 9-11: Applicants recite The dispersion liquid of surface modified titanium dioxide fine particles according to claim 8, wherein said aqueous solvent has a pH value of 3 to 13 (claim 9), wherein said aqueous solvent is a pH buffer solution (claim 10); and wherein said aqueous solvent is physiological saline (claim 11).

Okabe is silent on the solvent is pH buffered physiological saline solution.

21. Regarding claims 12-13: Applicants recite The dispersion liquid of surface modified titanium dioxide fine particles according to claim 9, for use as an auxiliary material for phototherapy in which the auxiliary material is introduced into the body in its affected region and light such as ultraviolet light is then applied to the affected region to destroy the affected region (claim 12) wherein said affected region is a cancer tissue (claim 13).

Okabe is silent on the surface modified titanium dioxide fine particles for use as an auxiliary material for phototherapy.

It is clear that Okabe teaches all the limitations in claims 9-13, except it is silent on TiO₂ dispersion in pH buffered physiological saline solution and use it in phototherapy for treatment of cancer tissue.

Blake et al. disclose TiO₂ with HeLa cells (cervical carcinoma) were washed and mixed with phosphate buffered saline (PBS), reads on pH in the range of 3 to 13, containing SOD (superoxide dismutase). The mixture was irradiated with a 500 W high pressure mercury lamp

filtered to transmit 300-400 nm light, reads on UV light. **Tumors** caused by transplanting HeLa cells into nude mice were **suppressed by irradiation with 300-400 nm light in the presence of TiO₂** (page 28, Tumor Cells), which reads on a phototherapy for treatment of cancer tumor.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains to utilize the teaching from Okabe using **surface treated TiO₂ having extremely high catalytic activity per unit area** and suggestions from Blake et al. to make buffered saline solution of the surface treated TiO₂ and use it for phototherapy treatment of cancer tissue.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chun-Cheng Wang whose telephone number is (571)270-5459. The examiner can normally be reached on Monday to Friday w/alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Chun-Cheng Wang
Examiner
Art Unit 4171

/CCW/

Daniel S. Metzmaier
/Daniel S. Metzmaier/
Primary Examiner, Art Unit 1796